



Washington State Enhanced Hazard Mitigation Plan

Methodology

The following details the methodology for the various elements of the risk assessments conducted for the SHMP.

- **State facilities data** – During the 2009 Legislative Session, the State Office of Financial Management (OFM) was tasked with the responsibility to create a new system for capturing all state-owned lands and facilities, both owned and leased. This project ran concurrent with the Emergency Management Division's update of the same data. The following is a recap of the project as undertaken by OFM and EMD.

The first task completed by OFM was to research and create a database which would gather more relevant, detailed data. In an effort to accomplish this task, EMD worked with OFM to seek grant funding, and OFM applied for a HMGP Grant to continue to enhance this dataset during 2010.

In an effort to streamline efforts and work together on this project, State EMD and OFM pooled together the requirements needed for both agencies, conducting a needs assessment. At this point, it was determined by emergency management staff that it would be overly burdensome to expect state agencies to update their facilities data for EMD purposes, and a short time later for OFM purposes. Based on the needs assessment, the information gathered by OFM would include the necessary information required by EMD, being much more extensive than what had been gathered historically.

In order to maintain consistency and ensure some level of coverage statewide, it was determined by the State Mitigation Strategist that where data was lacking from state agencies for the 2010 update, the previous data used for the 2007 plan edition would again be utilized, with some new information incorporated when available. The expectation is that OFM will complete the database by the 2013 update cycle, enabling a more thorough risk assessment.

OFM then set about gathering the data from all state agencies concurrently. Several meetings were held with all State Agencies, OFM and EMD, including those who are partners to the State's Hazard Mitigation Plan. Given the large undertaking, different due dates were assigned to provide the information based

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on the specific agency, e.g., the larger the number of properties, the more time was provided to gather all of the necessary data.

The first phase of the project was completed in late January 2010. Because of this, there was little time for data validation and in-depth, detailed analysis. During the next planning cycle, OFM and EMD will work together to continue to enhance the data. It should be noted that even with the potential errors in the newly-captured data, the level of accuracy is greater than the previous plan editions.

The dataset utilized to run the 2010 risk analysis includes information on more than 8,554 state agency owned and leased facilities statewide. Previous plan editions estimated in excess of 11,000 facilities. During this update process, it was discovered that many of the facilities listed as being “owned” by the state were, in actuality, not. Additionally, in past Facilities Inventory System (FIS) reports, the subleasing agency reported their lease and the master leasing agency reported the total leased space, thus double-reporting the subleased space. These changes and others reduced the number of facilities reported in 2009. Likewise, of the 7,201 owned facilities, other contributing factors also precluded their inclusion in the analysis as follows: outside the state - owned 2, leased 23; no lat/long or address provided - 13 owned; 1 leased.

Loss estimations are based on the dollar value established at time the property was purchased; the initial building cost. This also causes deficiencies in loss estimations as dollars will need to be converted to current day figures given that properties were purchased as far back as 1920. This will be one of the areas which we will have to address during the next maintenance cycle.

Likewise, the issue of replacement value also needs to be addressed. Currently OFM is still researching an avenue to proceed with respect to calculating replacement costs, since this is another area of deficiency. At the present time, OFM's intent is to include replacement valuations in the 2010 FIS calculated in a method similar to the one created by Meng Analysis, which they used in determining their Higher Education formulation.

In this scenario OFM would ask agencies to define each facility as heavy, medium or light constructions using Meng definitions. OFM would then use the price index for Seattle and Spokane, and the Seattle Consumer Price Index (CPI) to develop a high level replacement cost index. The strategy is still under development as it is presently unknown how much, if any, of Meng formal's are proprietary. If OFM elects to follow this pathway, the enhanced data would be available sometime after October 1, 2010, and should be available during the next plan update cycle.

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Risk Assessment Methodology (State Facilities at Risk):

Various geo-spatial datasets for hazard zones were used in combination with geo-referenced facility information from the OFM database to determine the state facility projected loss information. The dataset(s) used for each hazard are described in detail below.

Earthquake – The analysis of state owned and leased facilities vulnerable to earthquakes used the 2008 National Seismic Hazard Map - 2% Probability of Exceedance in 50 Years, developed by the USGS. To determine the state facilities that were considered at risk to earthquake hazards, a spatial query was performed to determine the leased and owned facilities that were within areas with a percent gravity (%g) greater than or equal to 18%. Based on the Mercalli Index of VII ($\geq 18\%g$) this percent gravity produces strong shaking and building damage to structures that would require repair after the event. This Mercalli Index threshold was recommended by the State's Chief Hazards Geologist, Tim Walsh. Spatial data for this analysis was downloaded from the USGS website at <http://gldims.cr.usgs.gov/website/nshmp2008/viewer.htm>. Spatial analysis was performed using ArcGIS Desktop – ArcInfo software.

Flood – For the analysis of state owned and leased facilities vulnerable to flood the Q3 digital flood dataset available from the Department of Ecology was used. The Q3 digital flood data was derived from the Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA). This dataset contains digital DFIRMs dated either 1996 or 1998 depending on the each specific county. While some newer digital flood data is available for select counties, this layer is the most current statewide layer available to determine vulnerability to flood hazards. The state owned and leased facilities vulnerable to flood were determined by performing a spatial query of those facilities that were located within the special flood hazard area indicated within the Q3 digital flood dataset. Spatial analysis for this hazard was performed using ArcGIS Desktop – ArcInfo software.

Tsunami – The analysis used digitized tsunami inundation maps developed by DNR based on tsunami modeling performed by NOAA and feedback from local jurisdictions. The communities covered by these maps include coastal counties, the inland waters of the Puget Sound, and the Strait of Juan de Fuca. The inundation areas for coastal counties were based on a tsunami generated by a M9.1 earthquake on the Cascadia Subduction Zone. The inundation areas for the inland waters of the Puget Sound were based in a tsunami generated by a M7.3 earthquake on the Seattle Fault and a tsunami generated by a M7.1 earthquake on the Tacoma Fault. State owned and leased facilities determined to be at risk to tsunamis were determined based on a spatial query performed for those state facilities that were located within the tsunami inundation zones. The spatial analysis was performed using ArcGIS Desktop – ArcInfo software.

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Landslide – The Landslides (24K scale) spatial dataset developed by the Washington State Department of Natural Resources in April 2009 was used to determine the state owned and leased facilities vulnerable to landslides. State owned and leased facilities within 500 feet of a landslide were considered at risk to future landslide activity. The threshold of 500 feet was considered reasonable for determining risk, as a landslide within this distance could block road access or use of essential functions of a state facility. Spatial analysis was performed using ArcGIS Desktop software. The landslide dataset used for this analysis is available in GIS format from the DNR GIS Data Center at:

www.dnr.wa.gov/ResearchScience/Topics/GeosciencesData/Pages/gis_data.aspx

Volcano – To determine the vulnerability of state facilities to volcano hazards, the lahar and pyroclastic flow hazard zones developed by the USGS Cascades Volcano Observatory in 1996 and 2004 were used. To following zones were used for each volcano: Mt. Baker (1996) – Case 1 and Case M zones, Mount St. Helens (2004) – Zones VEI 2-3 (1M m³, 3M m³, 10M m³, 30M m³, and 100M m³ flow volumes) and Zones VEI 4-5 (1M m³, 3M m³, 10M m³, and 30M m³ eruption flow volumes), Mount Rainier (1996) – Case 1 lahar zone only, Mount Adams (1996) – lahar zone, and Glacier Peak (1996) – lahar zone. A spatial query was performed to determine which state owned and leased facilities were located in each of these hazard zones. Facilities located within the volcano hazard zone indicated, were considered at risk to a potential volcanic event.

Wildland Fire – The September 2004 Wildland-Urban Interface (WUI) High Risk Communities dataset developed by the Washington State Department of Natural Resources was used to determine the state owned and leased facilities at risk to a potential wildfire. Using this data, a spatial query was performed to determine which state owner and leased facilities were located within these WUI High Risk Communities. Those facilities located within a WUI boundary were considered at risk to a potential wildland fire event. This data is the most currently available dataset for the designation of wildland-urban interface communities in Washington State.

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Hazard Profile Analysis (data utilized to determine counties at risk):

Earthquake – The analysis of vulnerability to earthquakes used the 2008 National Seismic Hazard Map - 2% Probability of Exceedance in 50 Years, developed by the USGS (Open File Report 2008-1128). The National Seismic Hazard Map (2008) displays earthquake ground motions for various probability levels across the United States and is applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. This update of the map (previous releases were in 1996 and 2002) incorporates new findings on earthquake ground shaking, faults, seismicity, and geodesy. The resulting maps are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the frequency of exceeding a set of ground motions. The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquakes and associated ground shaking obtained from interaction in science and engineering workshops involving hundreds of participants, review by several science organizations and State surveys, and advice from two expert panels. The National Seismic Hazard Maps represent the assessment of the "best available science" in earthquake hazards estimation for the United States. The spatial data and full report can be accessed online at the following USGS websites: <http://pubs.usgs.gov/of/2008/1128/> and <http://earthquake.usgs.gov/hazards/products/conterminous/>.

Flood – For the analysis of vulnerability to floods, the Q3 digital flood dataset available from the Department of Ecology was used. Digital Q3 flood dataset was derived from Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA) for each county in Washington State. The FIRM is the basis for floodplain management, mitigation, and insurance activities for the National Flood Insurance Program (NFIP). This dataset contains digital DFIRMs dated either 1996 or 1998 depending on the specific county. The spatial data and metadata for each county's Q3 Flood Data can be downloaded from the Department of Ecology's website at: www.ecy.wa.gov/services/gis/data/flood/q3flood.htm.

Tsunami – For the analysis of vulnerability to tsunamis, the tsunami inundation maps developed by DNR based on tsunami modeling performed by NOAA and feedback from local jurisdictions were used. The communities covered by these maps include coastal counties, the inland waters of the Puget Sound, and the Strait of Juan de Fuca. The inundation areas for coastal counties were based on a tsunami generated by a M9.1 earthquake on the Cascadia Subduction Zone. The inundation areas for the inland waters of the Puget Sound were based in a tsunami generated by a M7.3 earthquake on the Seattle Fault and a tsunami generated by a M7.1 earthquake on the Tacoma Fault.

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Wildland fire – The September 2004 Wildland-Urban Interface (WUI) High Risk Communities dataset developed by the Washington State Department of Natural Resources was used to determine vulnerability to a potential wildfire. This data is the most currently available statewide dataset designating the location of wildland-urban interface communities. The digital data for WUI High Risk Communities can be downloaded from the DNR website at: <http://fortress.wa.gov/dnr/app1/dataweb/dmmatrix.html> .

Cost and Area Calculations for State Facilities:

Total and average original cost and area (square footage, ft²) was calculated for all state facilities that were determined to be at risk to each of the six natural hazards included in this plan. The original cost value for each owned structure was used to determine approximate value of state facilities at risk, as an assessed or replacement value was not collected by OFM during the 2009 data update of state owned and leased facilities. The monthly rental value for each of the leased state facilities was used to determine approximate revenue that is generated by those leased state facilities at risk to each hazard. As with the owned state facilities, the leased state facilities dataset did not include an assessed or replacement value to determine the approximate value of leased facilities at risk to hazards. The number of leased and owned facilities that did not report the monthly rent or original cost for each structure was 8.3% and 40.9%. Therefore, the average original cost and average monthly rental values should be considered an underestimate of the true value of structures and rental income at risk to state facilities.

State Facility Type	Monthly Rental/ Original Cost Not Reported	Total # State Facilities	% Not Reported
Leased	109	1309	8.3%
Owned	2944	7201	40.9%
State Facility Type	Square Feet Not Reported	Total # State Facilities	% Not Reported
Leased	10	1309	0.8%
Owned	29	7201	0.4%